

Karbi Women and Environmental Conservation

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Abstract

Women in traditional societies have a close connection with the environment through their *roles* as farmers, collectors of water and firewood, caregivers to livestock and, sometimes, as priestesses and healers. The gender roles assigned in traditional societies bring women into direct contact with the natural resources for management of their daily household chores. Therefore, any loss of biodiversity has a direct impact on the lives of women, families and society at large. In the context of the Karbis, a major ethnic group of Assam, India, forests are central to their worldview and all aspects of their socio-cultural life. It is important to note that the Karbi belief system gives reverence to nature worship and the forest deities are called *Longri Arnam*. As such, sacred groves are among one of the best practices of biodiversity conservation that are also associated with traditional knowledge systems in different ecological zones. They are preserved mainly through observance of taboos and animistic rituals. In recent times, forest degradation has become a major concern and it is necessary to understand the role of traditional knowledge systems *vis-a-vis* their relation to ecological heritage and conservation. This paper examines the ways in which women in Karbi society have directly or indirectly acted as agents of environmental conservation. Using historical methodology, the study attempts to analyze interface between women and environment in the society with special reference to women's contribution to the society in combating climate change.

Keywords

Conservation; Environment; Sacred Groves; Climate Change; Sustainability

Introduction

Environment as a concept has myriad of interpretations, though it essentially refers to a physical surrounding that is common to all living beings. It includes all biotic and abiotic components. The term is derived from a French word *environmer*, which means ‘to surround or to encircle’. Since The United Nations Conference on Environment and Development (UNCED), also known as the ‘Earth Summit’ held in Rio de Janeiro in June 1992, there has been an ongoing discussion about the need to practice sustainability, particularly in terms of harnessing Earth’s resources and creating an awareness about climate change. It also led to two key conventions to create more biological diversity and to combat desertification that has served as guides for policymakers to take action-oriented goals for environmental protection from a gender perspective. The UNCED document called ‘Agenda 21’ dedicated a specific chapter wholly on gender to draw attention to the important role women can play in sustainability of Earth’s resources. The relationship between women and environment is not just limiting to women residing in developed nations, but worldwide women have shown to leave lesser carbon footprint than men (Resurrección, 2013).

The women’s movement on environmental protection has been noted and it received attention as early as two decades before the world conferences held in Mexico in 1975 and Nairobi in 1985 spearheading awareness of the intrinsic relationship between women and environment. Across the world, there has been ample evidence of women being at the forefront of defending nature and the environment globally. In India, for example, the Chipko Movement received worldwide acclaim (Shiva, 1988). The World Bank in 1991 stated that, ‘Women play an essential role in the management of natural resources, including soil, water, forests and energy and often have a profound traditional and contemporary knowledge of the natural world around them’. There is a close relationship between women and nature as they take primary responsibility of managing the natural resources which are often the basis of their livelihood. These international agreements point towards the great stride women have contributed towards environmental protection and thus they should be equal participants to decision making concerning the environment.

Gender plays a significant role in the division of labor and women have been closely connected to the management of local ecological resources. This is because, in traditional societies, gender roles have relegated women to household chores and, often as part of their chores, their work is centered around managing natural resources. It is significant to mention that, in many communities around the world, women in traditional societies have played crucial roles in the conservation and management of ecological resources for the family. There are numerous examples of women spearheading campaigns for protection of trees or conserving natural waters for the family.

In India, the tribal people have contributed immensely to the conservation of environment. Majority of the cases of sustainably managing the nature and natural resources have linkages with the tribes inherently leading their life traditionally. India has the second largest concentration of tribal population in the world (Gupta, 2018), and they account for more than 8.01% of the total population of the country. Known by various names, such as *adivasis*, *moolvasis*, *janajati* and as ethnic minorities (Marianus, 2011), they inhabit various states of India (9 states have sizeable populations). The tribals occupy about 15% of the total geographical area of India mainly comprising hills, forests, inaccessible terrains of plateau areas. Many tribal communities have traditionally lived as isolated groups untouched by the urban societies around them. The tribal communities live in close communion with nature and their worldviews and religious beliefs have closer affinity with the plant and animal world, which, in turn, leads to sustainable use and conservation of nature (Western and Wright, 1994).

The Karbis and Ecological Landscape

The Karbis are one of the largest tribal communities in Assam and have a close relationship with land and forests. Like most tribals, there is no private ownership of land as the land is owned by the community under the leadership of village head. A Karbi village is called *rong* and, traditionally, the whole village shares equal responsibility for cultivation and other economic activities, with the harvests being distributed equally. The Karbis are a clan-based society binding the community and integrates all sections of the village. Therefore, it may be said that there is not much exploitation of land. The community works together and collects the material for their economic needs as per their requirements (Pereira *et al.*, 2012). Karbi Anglong is the largest district in Assam with an area of 10,434 sq. km. It is bordered by Golaghat district in the east while in the west it is bounded by Morigaon district and a part by the Meghalaya state. The districts of Nagaon and Golaghat lie in the North while North Cachar Hills lie towards the South. It is situated between 25° 33' N to 26° 35' N latitude and 92° 10' to 93° 50' E longitude. In the year 2015, a new district called the West Karbi Anglong was created falling under the jurisdictional of Karbi Anglong Autonomous Council. The topography of the district consists of both hills and plains with 85 percent of the district being covered by hills. Approximately 7,983 sq. km. of the geographical area is under forest cover, and this constitutes 76.5 % of the total area. The forest areas are divided into three categories:

- A) Very dense forests – 586 sq. km.
- B) Moderately dense forests – 3,801 sq. km.
- C) Open forests – 3,596 sq. km.

Karbi Anglong is replete with natural forests and sacred groves. Sacred groves are specific forests, landscape or water bodies protected by the people and generally located on the outskirts of settlements, being the abode of local deities or ancestral spirits. These forests are a great example of *in situ* conservation (Anderson, 2003). As sanctuaries and places of worship, the local communities take care of day-to-day management of sacred groves playing a key role in conservation since they are associated with their spiritual and cultural values. Certain species of the sacred trees are considered to have healing properties and are sometimes even associated with legends of the community. In changing times with biodiversity being threatened, these sacred groves represent a vital gene pool and promote the conservation of many endangered species on the verge of extinction (Gadgil and Vartak, 1976). Ecologically, sacred groves help preserve soil and water apart from protecting biological biodiversity (Hughes and Swan, 1986).

Folk traditions, such as the legend of *Kajir Ronghangpi*, express the centrality of women in the Karbi worldview. Kajir Ronghangpi is the daughter of Hok Ronghang who is projected as a lover of wildlife and who attained divinity after her sojourn on Earth. She is given the credit for conservation and establishment of the Kaziranga National Park in Assam, the home for the one-horned rhinoceros (*Rhinoceros unicornis*). Kajir is believed to have brought *kindu* (rhinoceros) with her on the journey to Earth after which she returned to the heaven leaving the animal behind.

In tribal communities, such as the Karbis, the role of women in socio-economic activities is well recognized. They constitute half of the total population, and work alongside men to maintain the family. The Karbi women perform multifarious tasks that include collecting and storing water, securing sources for fuel, collecting food and fodder for livestock as well as collect edible plants etc. from the forests for their daily needs. In fact, it can be said that the whole community is dependent on the labour of the women due to their role in economy and also as caregivers to children, elderly and the sick. They provide sustenance to the family on the individual level and broadly to the community through the judicious use and management of the natural resources. Their traditional knowledge of biodiversity, for example, has facilitated the healing practices, and thus the Karbi women have traditionally been an agency for environmental conservation due to their close relationship with nature. However, it may be noted that in spite of the crucial roles they play in the society, the Karbi women have no-property rights, and, thus, are at a disadvantaged position when it

comes to economic security. The ambitious *Agenda 2030: Sustainable Development Goals* adopted by the United Nations in 2015 embodies a roadmap that addresses the root cause of poverty, inequality and empowerment for all countries. It identifies women's land rights as a crucial force for achieving income, health, and empowerment that can realize the sustainable development objectives.

The Karbi belief system gives reverence to nature worship and the term used for forest deities is *Longri Arnam*. As such, sacred groves are among one of the best practices of biodiversity conservation that are also associated with traditional knowledge systems in different ecological zones. They are preserved mainly through observance of taboos and animistic rituals. In this context, the *UN Declaration on the Rights of Indigenous Peoples, 2007* addressed the protection and recognition of sacred natural sites. In recent times, forest degradation has become a major concern and it is necessary to understand the role of traditional knowledge systems *vis a vis* their relation to ecological heritage and conservation. This paper examines the ways in which women in Karbi society have directly or indirectly acted as agents of environmental conservation. Using historical methodology, the study attempted to analyze an interface between women and environment in the society with special reference to women's contribution to the society in combating climate change.

Area of Study

The study was carried out in Hamren town situated in Donka circle of West Karbi Anglong district of Assam having a population of 8,747 individuals out of which 4,327 are females (Census of India, 2011). Hamren is predominantly inhabited by the Karbis. Their traditional animistic belief system known as *Honghari* is intricately linked to the sacred groves that are present in abundance in Hamren. The ecological landscape has, therefore, facilitated livelihood and sustenance of the nearby villages of the district.

Methodology

This study has been conducted mainly using historical methodology, which is supplemented by field study to understand the subject from a wider perspective. The field study undertaken (November 2021-April 2022) included participant observation, questionnaire survey, focus group discussions, interviews of select inhabitants of Hamren including ethno-gynecologists. Regarding the structure of the questionnaire, the first section was on biographical information of the respondents. The second section focused on livelihood aspects of the Karbi community and their connection with forests. The third section was constructed keeping in mind the gender dimensions of labour and the multitude of work carried out by women with implications for conservation of the environment. The fourth section related to questions and suggestions on prospects and challenges aspects on forests, land and water sources, etc.

The criteria for selection of the participants, both men and women, were based on the following:

1. A participant is defined here as a self-declared Indigenous adult of the Karbi community, a resident of Hamren, who has resided for at least 15 years in Hamren; and who is familiar with some traditional knowledge of ecological aspects. Initial contact was made through a telephonic survey due to the pandemic related challenges. Additional participants were obtained using the snowball sampling technique through referrals from the initial participants to expand the list of informants.
2. Attempts were made to collect information mainly from women as the study is based on Karbi women's role in conservation. However, gender relations cannot be ignored in understanding issues of environmental conservation, and, for this reason, data collection was also done from men of Karbi community as well.

The survey was conducted on a cross-section of the Karbis of Hamren, both men and women, and the various sections of the community such as traditional healers, priests, dirge singers, cultivators, etc. However, a maximum of the significant questions was answered through Focus Group Discussions (FGDs). FGD was carried out with two groups; the first group and second groups consisted of 11 and 15 participants, respectively. The data collected through these informal discussions have been analyzed with the information collected from questionnaire survey. This was supplemented by random informal interactions with local people who went about doing their daily chores like drawing water, collecting firewood from the forests, and collecting edibles from the forests, and so on.

Karbis and Traditional Knowledge System

Socio-economic status is a major determinant of a development of a society. Social factors could at times influence the overall scenario of development prospects. The degradation of forest due to urbanization has severe and long-term impacts on the community that are dependent on forest resources (Banerjee and Chowdhury, 2013). The Karbis is a tribal community, and their livelihoods are intertwined with their religious beliefs. Farming and cultivation are the main sources of income. In Karbi Anglong, most of the people live below the poverty line. Their income level was not sufficient to lead a good quality of life. The men are mostly engaged as manual labour or farmers etc. Hunting and fishing form another core of their livelihood activities. The men have been rendered vulnerable economically because many of the forest areas are being cleared for settlements and other developmental activities. Fishing for commercial purposes has also been a major cause of the depletion of fishes in the rivers. The role of women in this regard cannot be overlooked as they contribute on par and sometimes more than the men in the family's income. Karbi women not only perform the traditional roles as wives and mothers but economically they work alongside men to substantiate the family's income. Animal rearing, handicrafts, farming and selling of wild edibles plants are the main sources of income of the Karbi women.

The Karbi religious system places greater importance to the concept of the soul or *akarjong*. The Karbis consider every animate and inanimate entity to possess a soul. Inanimate objects, such as soil, water, rock, and mountains, are considered embodiments of the living God and, thus, the Karbis revere all life forms and regard supernatural recreation as sacred (Sarma and Barpujari, 2011). Even though animal sacrifice is a part of the animistic beliefs of the Karbi, prayers are said to ask for forgiveness for the act. The Karbis have always believed in the concept of *Arnām keso* (it refers to the wrath of the territorial deity if an individual enters without offering prayers). So, they believe in harmony with nature. Folk wisdom is passed down from generation to generation, and rules and norms are devised to observe taboos around certain elements that reside in nature. Most Karbi's prohibitions, bans, and taboos are related to the age-old beliefs of *Honghari*. The Karbis also believed that their well-being and prosperity depended on respecting taboos. Taboos are traditions or social rules that aren't written down and are passed down orally (Colding and Folke, 1997). These forests are preserved in the names of gods and goddesses, and they are conserved for their religious significance. Sacred groves have a crucial role in the religious lives of the Karbis. The groves meet the spiritual needs of the local community and expand to provide for the economic, political, and social needs of the local community. Sacred groves are consulted for requests, pacification, and to avert inevitable misfortunes. There are certain beliefs that some spirits that reside around sacred groves have the power to offer a boon to people. The sanctity of the sacred groves which act as reservoir of biodiversity is maintained by both men and women. However, women are asked to observe more taboos pertaining to sacred groves. Karbi women are not allowed to enter the premises of the sacred groves.

Karbi Women and Environmental Concerns

The role of women in food production is significant as they are the largest producer of food especially in the developing world and the major workforce in agriculture (Bhattacharya and Rani, 1995; Saito and Spurling, 1992). Sustainable farming can be regarded as a philosophical approach that not only looks at commodity production but the effects it has on workers, consumers, and the entire environment (Agriculture Sustainability Institute, 2012). Sustainable agriculture refers to the production of food and animal products that are derived from farming techniques that protect the environment, humans and other living beings and provides economic benefits to the people. Women have always worked for a subsistence-based non-monetized form of the household economy. Since women spend a lot of time working on farm-based activities, they develop knowledge about the environment and subsistence economy, and they do not misuse it. However, because of technological inputs men became more involved with farming but, due to the migration of men to urban areas for jobs, the farming sector is left in the hands of women. Traditionally, the Karbi women have taken an active part in farming. Shifting or *jhum* cultivation is the form of agricultural practice of the Karbis in Assam in which women play a crucial role. *Jhum* cultivation requires a skillful knowledge of seed selection and preservation. Women with their intergenerational knowledge come in handy along with their close connection with nature. The Karbis' immense traditional knowledge in predicting annual seasons without any use of calendar gives them an edge in farming. They predict seasons based on understanding the characteristics of flora and fauna locally available. The characteristics of flora include leaf fall, formation of new leaves, flowering, budding, fruiting, and ripening of fruits etc. and that of fauna include courtship and mating, hatching of eggs, building of nests of different bird species, collection of food by ants etc. They also study the physical factors like rainfall, temperature, wind, length of the day and night etc., These are the ways through which the Karbis devised their own seasonal calendar based on understanding their local environment (Teron and Borthakur, 2009). The Karbi women perform majority of the work in shifting form of agriculture. They are engaged in all types of farming activities like seed selection, production, harvesting, storage of the harvest, and processing of the harvest. Women's immense traditional knowledge on the growing conditions of various plants and the nutritional value of various plants equips them with knowledge on seed selection and plant breeding. This enables them to adapt to the fluctuating weather conditions and ensure the survival of local crops that are well suitable to the local weather conditions and taste.

The traditional knowledge of Karbi women in pest management and control ensures good harvest. During rice cultivation, the women use various extracts of out neem (*Azadirachta indica*), drumstick (*Moringa Oleifera*) to control common pests. The Karbis also love to plant black sesame (*Sesamum radiatum*) paddy alongside r during shifting cultivation as they believe that planting black sesame prevents pests from eating the paddy. It also prevents wild plants from growing which ensures the paddy plant to grow in a healthy manner (Dkhar and Tiwari, 2020). The credit for sustaining the Indigenous seed variety must go solely to women.

Water Management

Women have a significant role in management of water resources since they have greater involvement and stake in both agriculture and household water usage though their perspectives and roles in water management are ignored by policymakers while framing policies and programs (Wahaj and Hartl, 2019). Karbi people are usually hill dwellers. In the hills, water is scarce and the Karbi women must usually go afar to collect water for the household use. The source of water in Karbi hills is usually through small streams, rivulets, and small waterfalls. Traditionally, the Karbi women collect water in a long bamboo tube called '*langpong*'. The sac inside the bamboo is removed to make it a long tube. The tubes are then carried in a traditional basket called the '*ingtong*'. The collected water is thus sustainable as they collect only as per their needs. Traditional beliefs play an important part in the act of water conservation. There are rituals

observed by the community to appease the water-spirits. These are in the form of prayers and making sacrifices, which could be through animal sacrifice or by offering banana plantains, tobacco, etc.

The Karbis believe that water has spirits in it. During the Focus Group Discussion, the participants equated water with a life form imbibing the spirit of a woman. Sometimes it is called *Langjangsarpi* (literal translation: a woman that dwell in the water bodies). The participants regard a woman as the stewardess of water bodies and that it is their responsibility to protect it and they consider it morally wrong to contaminate it. They also added that they observe strict rules when they are nearby water bodies. The taboos include not shouting and screaming, quarreling etc., and playing too much with water. They believe that disturbing the water bodies could incur the wrath of water deity, who when left undisturbed is benevolent. The participants shared that they do not waste any water when drawing water near the streams, rivulets or in dug pit wells nearby forests, as doing so could potentially attract the wrath of not only the water deities but the territorial deities as well.

Forests and Fuel

Traditionally, food is prepared by the Karbi women in a firewood stove, usually constructed of mud. Traditionally, women are given the responsibility of collecting firewood from the forests. Osei (1993) argued that fuelwood consumption is the most important cause of forest degradation in the developing countries that estimate around 54% of the global harvests per annum that links fuelwood consumption with forest loss. In the case of the Karbis, though they collect firewood from the forests, they are forbidden to chop off the branches of the trees. During the Focus Group Discussion, the women shared that they collect firewood in forests nearby their villages and they only collect dried wood. Usually, the practice is not to cut down any trees for firewood. The Karbis believe that trees in the forests are property of the territorial deity called *Longri Arnam*. This territorial deity is believed by the Karbis to protect all life-forms in the forests and intrusion is forbidden until and unless there is a formidable reason and should be done so through prayers. As the Karbis perform an annual ritual called '*Inglong ase*' to appease the territorial deity, they consider it safe to go to the forests and collect forests products.

Food and Local Resources

Culinary preparations of communities are reflections of their flora and fauna. It is not just the ingredients but many factors like culinary preparation, utensils used, presentation form, etc. are integral aspect of food retaining its nutritional value (Padilha *et al.*, 2012). There are six methods of cooking by the Karbis. They are *Kalangdang* (to just boil), *Kangmoi* (cooking using only water and alkaline solution), *Kimung* (to cook inside the bamboo tube), *Kangthu* (to cook anything with a banana leaf, mostly roasted in a fire or in a pan), *Kiphi* (to roast anything in the fire) and *Karnu* (to stir fry without using any oil). Karbi women have traditionally prepared food for the family. In these methods of cooking, there is no use of oil which can be considered healthy. Also, in these methods of cooking wild vegetables are used for cooking, locally sourced from the forests. Food preparation and cooking methods are critical components of healthy living because they determine the retention of nutritional values. Karbi women through their cooking has ensured the selection of not only nutritional fruits and vegetables but also ably retained the nutritional value.

Wild edible plants are used by the Karbis extensively and it is a major part of their diet. It supplements the staple crops and acts as famine foods during the times of food scarcity. Food and Agriculture Organization (FAO) has recognized more than 150 species of wild plants that are consumed in countries like India, Malaysia, and Thailand as emergency foods (Willan, 1983). Karbi Anglong has more than 60% of the area covered in dense forest. There has been a study that concluded that the Karbis who still live nearby undisturbed forests areas and source foods from those forests are found to be healthy and free from most

diseases. The Karbi women have traditionally depended on the forests for collection of wild edible food. This food could be plants, fruits, tubers, seeds, etc. In fact, forest-based foods still dominate the Karbi's kitchen in terms of its popularity. Forest provides a variety of nutritional food such as edible tubers, roots, rhizomes, leaves, shoots, flowers, fruits, nuts, seeds that have high nutritional and medicinal value (Panda, Panigrahi and Padhy, 2005). In the Karbi cuisine, foods are divided into edible food obtained from forest called *Inglong-ahan* (here, *Inglong* means mountain or hills and *han* means vegetables) and *Thoi-ahan* (here, *thoi* means plains). The Karbi traditional cuisine mainly includes *Inglong-ahan* while *Thoi-ahan* are considered by the Karbis as food of the non-tribals.

Traditional Settlement Pattern

The housing patterns of many tribal communities are planned to accommodate the larger social life alongside fully incorporating the organic materials that are widely abundant in their natural surroundings. The Karbi settlements are in the form of clusters, arranged in a way to form a social structure and the inter-relation in terms of social contiguity. The Karbi villages were traditionally not fixed settlements, and they were built after clearing the forests. Thereafter, it was shifted from place to place periodically when the soil of the land was exhausted by *jhum* cultivation (Lyll, 2011). Usually, the houses constructed are large. Dalton (1878) has also noted that they have the habit of lodging several families or even a whole village, which is why large houses are preferred. The materials used for constructing the house is generally derived from the materials readily available in their environment like wood, bamboo, and thatch. Indeed, the traditional dwelling place of the Karbis are either made of bamboo or wood and for thatching the roof cane reed is used. The house is raised several feet above the ground on a bamboo structure supported by wooden blocks. The raised structure and the ground have enough space for domesticated animals like pigs and goats to roam freely. The platform is covered on four sides by bamboo walls and there is only one entrance for people to go through. The entire house is constructed using only bamboo strips and there is no use of iron nails or wires. Men and women take equal part in construction of houses. Men are tasked with the construction of houses though women also provide help with the construction of bamboo walls (a skill both Karbi men and women are adept at). Women used to cake the walls and the floor with a mixture of mud and cow dung to cool the houses and increase the longevity of the walls. This method of caking is quite sustainable in the long run.

Animal Husbandry

The Karbis have a great affinity towards animal husbandry. Animals provide calories in the form of meat, milk and fat apart from important sources of livelihood for the local people. Animal rearing, especially that of goats, pigs, cows and country chicken, is considered an age-old occupation of Karbi women. However, swine-husbandry or piggyery is the most common form of animal husbandry practiced by the Karbi women. Studies have established that there is a close linkage between shifting cultivation and swine husbandry as the swine husbandry is based on recycling of waste resources derived from agriculture (Toky and Ramakrishnan, 1981). Thus, it becomes relatively cheaper with abundant primary resource-base. The pig shed and goat shed are constructed in raised bamboo platforms so that the droppings could be used as manure. Goats' manures are extensively used by the Karbis during farming. Goat manure improves soil texture as well as increases water retention in soil. Poultry and duck-husbandry are other popular economic activities of the Karbis. The chicken and duck coups are built of bamboos. The birds are left unattended for scavenging within a confined boundary. Majority of the work associated with animal husbandry is performed by women though other family members of the household take active part in occasional feeding of the domesticated animals. The feed for duck and poultry includes maize, rice, etc. Traditional piggyery farming of the Karbis involves feeding the pigs with wild taro (*Colocasia esculenta*) leaves, flaky dried rice husks, leftover fermented rice from rice beer and leftover food from the household. This farming practice is

sustainable as it does not harm the environment. Cattle and cows are also reared for farming purposes though the Karbis do not extensively draw milk from the cows. Dairy farming is not a common practice amongst the Karbis, and beef is forbidden to eat. Thus, cows and cattle are raised only for farming purposes. Through rearing of these animals, the women can earn extra income for the household. The food and fodder are mostly sourced from the forests.

Conservation of Medicinal Plants

Plants are the main source through which various traditional medicines are made. Traditional medicines have been around for millennia and have supported many societies in regaining and retaining their health. *Keso* (illness) is treated through various practices such as therapy, charm, and rituals in the Karbi society. *Kapherem* is a treatment whereby holy verses are chanted to cure minor ailments. The Karbis believe that some deity incurs their wrath on some people through ailments or illness and proper propitiation can heal it. Medicines concocted from plants are also given to the patient for better recovery. *Kachehi* is a traditional health practice involving applying medicinal paste topically in affected areas whereas *Kecho* is a health practice of orally consuming the medicines. *Seh Karkli* is a common practice amongst the Karbis to cure any type of illnesses. It involves chanting of prayers along with blood sacrifice mostly that of fowl and goat (Teronpi *et al.*, 2013). Some of the medicinal plants are home-grown though the vast majority is sourced from forests and sacred groves. Previous studies have shown that the Karbis depend on the forests for herbal medicines. The herbalists are mostly women with exception at times. It is reported that there are altogether 600 species of medicinal plants in Karbi Anglong and West Karbi Anglong. The Karbi people use various medicinal plants for treatment of various health related ailments and illnesses. These ethno-medicinal plants are preserved in the sacred groves of Karbi Anglong. Most of the time, elderly women are the repository of such vast traditional knowledge. The Karbis have traditionally protected and preserved certain species of plants and the place where they are planted because of their beliefs in the sacredness associated with the plants (Teron, 2008). This religious belief is instrumental to many rare forest species. Each of the clan and sub-clans of the Karbis has own clan and sub-clan totems which could either be a plant or an animal. It is revered, and they are forbidden to kill or eat totems. This leads to the conservation of flora and fauna.

As livestock keeping is an integral economic source for the Karbis, ethnoveterinary medicine or traditional animal healthcare has been a part of the Karbis traditional knowledge. Variety of plants have been used in the treatment and cure of various ailments and diseases that afflict animals. Flowers, seeds, roots, tubers, rhizomes, barks of trees and so on have been used to treat various diseases. Herbs and creepers are the most commonly used for concocting medicines. These medicines are prepared by a traditional healer called '*Kapherem abang*'. A traditional healer could belong to any of the gender. The medicine is concocted and is given either orally or topically. A *Kapherem abang* has assisted people and animals for generations by preparing medicines and treating them in the absence of modern medicines. As the Karbis lack written history, much of the traditional knowledge pertaining to ethnoveterinary medicine has been lost as there is no documentation. All that has survived is passing of traditional knowledge through the oral medium from generation to generation.

Karbis Women and Traditional Knowledge of Herbal Dyes

Dyes and colorants have a significant role in the textiles, crafts, cosmetics, and tattoo. Cotton yarn called *Honki* and silk yarn called *Eri* are the most widely used handloom items among the Karbis. The standard way of weaving clothes is through the handloom method. Even today, handloom garments are favored over synthetic garments. The Karbis use herbal dyes extracted from different process for weaving. Synthetic chemical dyes are suspected to be harmful causing allergic, carcinogenic, and other detriments to human beings. By contrast, natural dyes are thought to be environmentally friendly and beneficial. For example,

indigo gives a cooling sensation, while turmeric (*Curcuma longa* L.), the brightest of naturally occurring yellow dyes, is a powerful antiseptic, thought to revitalize the skin (Mahanta and Tiwari, 2005). The Karbis used plants, insects, and minerals for making dyes. The Karbis have traditionally made only certain colours like black, yellow, indigo, pink, red and white. Colours other than the above are not made by them. The most common parts used for making dyes are twigs, leaves, fruits, shoots, flower buds, barks, roots, rhizomes, etc. Insects, animals, and minerals are also used to make dyes. All works related to dyeing are performed by women and there is an elaborate process for the extraction of dye that can sometimes take a year to get the desired results. Though it is an arduous process, such dyes are not harmful, but are sustainable for the environment.

Childbirth and Childcare

Pregnancy is one of the most crucial stages in a woman's life and immense support and care ensures healthy baby delivery. Adequate nutrition is required for a mother to give birth to a healthy baby. The Karbi women observe strict diet restriction during this period. Red meat like pork, duck meat, mutton is restricted during the pregnancy period as it has high fat content. They are also forbidden to consume raw papaya as it contains papain and latex. The Karbis believed that eating raw papaya could lead to miscarriage. Eating pineapple is also discouraged along with other sour fruits. Scientifically, pineapple is loaded with bromelain that can lead to softening of the cervix and can cause early labour. Sugarcane is similarly avoided in fear of miscarriage as the juice could induce hyperglycemia (Bhattacharjee, 2021). Fish and local chicken is encouraged to eat by ethno-gynecologists. The role of ethno-gynecologists is very important in the Karbi society as they are the primary attendant and caregiver to women during pregnancy and childcare. Though modern medicine has made inroads in the rural areas of Karbi Anglong, yet the role of ethno-gynecologists cannot be curtailed. Since they have assisted a lot of Karbi women during childbirth for generations, many women trust them with their knowledge and follow their suggestions religiously. It is also difficult for rural women to discuss their problems effectively with a healthcare professional as many of the rural women are illiterates. The ethno-gynecologists living in rural areas are thus a much better option for them. The role of ethno-gynecologists revolves around preparing medicines for women during pregnancy if they fall sick, suggesting them proper diet, assisting them during childbirth and ensuring the proper growth of a child during the early years. Apart from ethno-gynecologists, all women are given the primary tasks of caregiving to the children. They are the first attendants when a child falls sick, and they seek alternative traditional herbs available in the nearby forests to give immediate and temporary relief to the sick child. All Karbi women are required to have some knowledge on ethno-medicine as they have to be self-sufficient in taking care of children themselves though during emergency, ethno-gynecologists are the first to be sought after. As the Karbis live mostly nearby forests areas, it provides them abundance of plants to make medicines which is helpful for them during ailments. The ethno-gynaecologists make use of the natural resources available in the forest to make various concoction needed for the women in the village.

Food Preservation

Efficient post-harvest handling and storage can potentially contribute to socio-economic empowerment in developing nations (Mobolade *et al.*, 2019). Grains are the most vital diet component for the majority of population all around the world (Duranti, 2006). In tropical areas, food grains are the most durable food commodity for storage and preservation that are also used as seed for planting. Post-harvest storage and preservation have always been considered a part of women's household chores. These Indigenous practices originate from culture's connection with a specific type of environmental condition and emerge as a result of traditional societies developing ingrained consciousness of their natural surrounding (Mobolade *et al.*, 2019). Karbi women take precautionary measures for proper storage of grains that include maize, legumes, different types of pulses and paddy. The grains are sun-dried to remove moisture and are stored in traditional

bamboo structures that is thatched and constructed above the ground. The bamboo is sun-dried as well as fire-dried to remove all forms of moisture before making a makeshift-structure pre-harvest. All types of grains are dried in the sun in the process called solarization. It is an age-old practice of farmers, especially of regions where temperatures are high and reach above 20 degrees Celsius (Chua and Chou, 2003). Karbi women in rural areas have been sustainably preserving food for ages. Despite the absence of electricity in rural areas and, thus, in the absence of refrigerators, women through the traditional method of food preservation have prolonged the longevity of food that reduces wastage of food in the long run. A common method of food preservation observed amongst the Karbis is using salt to preserve meat. Sometimes, it is done through smoking and fire-drying. Bamboo shoot, a traditional delicacy is also fermented as storage and used year-round. In case of leafy vegetables and other plant-based edibles, it is stored in green banana leaves to keep it fresh for a longer period. Karbi women also preserve many food items for consumption round the year. Fruits that are plentiful during the winter season are dried and stored in a dried bamboo tube. Bamboo shoots are fermented and stored in jars or in bamboo tubes and are also dried. In rural areas, the concept of community fishing is quite popular, and people are encouraged to fish judiciously in community fishing ponds or rivers. However, during the period of collection of a huge quantity of fishes, they are dried in the sun or near the fireplace for later use. In fact, it is a common practice to sun-dry or smoke-dry all types of fish and meat items.

Handloom and Handicrafts

As per the Third Handloom Census: 2009-10, 57.6% of workers were female while the rests were males. In the case of the Karbis, handloom as an art and craft has traditionally been a key occupation of the women. It is considered a taboo for men to touch the handloom accessories or practice handloom. Handloom has been an integral aspect of women's chores and not considered as an economic aspect. Karbi women traditionally weave clothes for the entire family. The art of handloom is imparted from one generation to another. In recent years, machine-made products are putting a hard competition for hand-woven garments, yet the popularity of age-old handloom cannot be ignored. Majority of the Karbi women possess traditional fly-shuttle looms called *therang*, which is generally installed on the walls of *verandah*. They, alongside, rear cocoons derived from silkworms. Eri and cotton are the chief clothing materials. These two materials are decomposable and do not harm the environment like other threads such as rayons, viscose, etc. do.

Bamboo is the most readily available natural resource in the region. Karbi women are famous for their handicraft skills. Alongside men, they participate in making different handicraft items made especially from bamboo and wood. A Karbi household is replete with items made of bamboo. The list includes household items like *Hoton*, *Hak*, *Ington* (different types of baskets), *Tar* (mat), *Sang-rangtik* (rice basket), *hijap* (hand fan), *Khangra* (for carrying firewood and vegetables), *Kove-thok* (for storing betelnuts and betel leaves), *Vo-um* (basket for carrying small birds), *Harlung* (drinking cup) and so on. Many wooden handicrafts like *Kasu* (plates), *Lumplak* (spoons), *Longtok* (mortar and pestle), *Inghoi* (short stool), etc. are also made by women. The art of handicrafts is open to both the genders who take great interest in creating them. Traditionally, all the Karbis use only these bamboo and wooden items in their house. The use of such materials is sustainable and does not harm the environment.

Main Findings and Conclusion

An analysis of the data obtained points towards the fact that Karbi women are highly dependent on the forests for their livelihood and sustenance. According to the participants, the forests provide them with readily available sources needed for their survival. The religious beliefs of the community are the most influential factor in the women's using sustainable means to draw forest products. It is their beliefs that dictate that they revere the forests and the environment at large. Eco-cosmology is the core of their belief

system. A symbiotic relationship can be observed as women revere and protect the environment judiciously. However, this outlook, which is derived from their religious beliefs on sustainability and regards to Mother Nature, is slowly diminishing. This is in part due to the changing notion on the environment due to globalization and urbanization and the swift conversion of many Karbi into Christianity and other religions. This has, in turn, led to a shift in the habits and attitudes of Karbi women in recent times. During the interviews, it is revealed that though women acquire their daily needs from the forests, they only do so because of their economic needs. They argued that, if they were affluent enough, they would forego foraging in the forests for their sustenance. Thus, forest dependence could be regarded as a method of survival for people living in poverty.

Overpopulation leads to over utilization of natural resources. This overutilization is done through the help of technology which destroys the environment. The sustainable practices of women for collection of fuel and food have been on the decline, as technology has taken over the traditional roles of women. It is pertinent to impart adequate environmental education and awareness so that they can act more efficient than men and can use technology in environmental conservation. Women should also have access to education so that they will have more knowledge about their bodies and make the proper decision for their family in terms of family planning, health, and energy utilization, etc.

The degradation of environment over the last few decades has only worsened their condition. Illegal cutting of trees and mining of natural resources, combined with clearing of huge patches of land for villages and farming, has depleted the forests and wildlife areas. Freshwater supply is depleted as a result of land clearing and urban construction activities. As already discussed, women are tasked to collect food and water, depletion of resources results in them having to travel much farther than before. This leads them waste a lot of their productive time. This also increases risks of the sexual harassment. Indigenous traditional knowledge on handloom and handicrafts, ethnobotany, ethno-medicine, herbal dyeing is declining as people are getting more dependent on machineries and modern science for their needs. Modern machineries can produce faster and cheaper products in huge quantity resulting in many women giving up their skills of arts and crafts. Elderly women are mostly the reservoir of Indigenous knowledge on medicine and ethno-botany, but the skills have not been imparted to the younger generation on a wider basis like it used to be.

This research sought to gain a perspective on the different ways Karbi women have protected the environment and the ecosystem through traditional methods and Indigenous knowledge. Based on the responses of the respondents, it becomes apparent that women's contributions to the household go beyond the traditional roles. An Indigenous perspective on the environment opens new liberating ideologies broadening the modern ideas of preservation. One of the outcomes of the research findings is that there is a unified beliefs surrounding conservation of environment though the elderly is keener on not disturbing the natural environment due to their age-old belief systems.

Much of the rural economic activities in Karbi Anglong are based on sustainable use of the natural resources. Though the natural resources are still abundant, but the transformation of rural economy could lead to a devastating effect in the near future. Women and men have different approaches to natural resources management, with women being given a greater degree of knowledge in conservation of the ecosystem. As such, Karbi women have low literacy. Despite their knowledge about conservation of environment they are not considered important. Women are at the forefront in many farming-based activities because of their tremendous knowledge of management of natural resources, preservation, and innovation; yet the representation of Indigenous women in decision making of combating biodiversity loss is not visible. It is important for policymakers to understand these gender-based roles of nature management and ensure that along with men, women's specific knowledge in nature conservation is indispensable.

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Authors' Declarations and Essential Ethical Compliances

Authors' Contributions (in accordance with ICMJE criteria for authorship)

Contribution	Author 1	Author 2
Conceived and designed the research or analysis	Yes	Yes
Collected the data	Yes	No
Contributed to data analysis & interpretation	Yes	Yes
Wrote the article/paper	Yes	Yes
Critical revision of the article/paper	Yes	Yes
Editing of the article/paper	Yes	Yes
Supervision	No	Yes
Project Administration	Yes	Yes
Funding Acquisition	No	No
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Research involving human bodies (Helsinki Declaration)

Has this research used human subjects for experimentation? No

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Research involving Plants

The research did not involve plant species.

Research on Indigenous Peoples and/or Traditional Knowledge

Has this research involved Indigenous Peoples as participants or respondents? Yes

(Optional) PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)

Have authors complies with PRISMA standards? Yes

Competing Interests/Conflict of Interest

Authors have no competing financial, professional, or personal interests from other parties or in publishing this manuscript.

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SELF-DECLARATION FORM Research on Indigenous Peoples and/or Traditional Knowledge

The nature and extent of community engagement should be determined jointly by the researcher and the relevant community or collective, taking into account the characteristics and protocols of the community and the nature of the research.

If your research involved/involves the Indigenous Peoples as participants or respondents, you should fill in and upload this Self-Declaration and/or Prior Informed Consent (PIC) from the Indigenous Peoples. [Please read carefully <https://grassrootsjournals.org/credibility-compliance.php#Research-Ethics>]

1. Conditions of the Research

1.1 Was or will the research (be) conducted on (an) Indigenous land, including reserve, settlement, and land governed under a self-government rule/agreement or?

Yes

1.2 Did/does any of the criteria for participation include membership in an Indigenous community, group of communities, or organization, including urban Indigenous populations?

Yes. The study is conducted on the Karbis of Assam. They are one of the indigenous tribal communities residing mostly in Karbi Anglong and West Karbi Anglong districts of Assam. The study involves personal interviews of Village elders and women as they are considered the keeper of the environment.

1.3 Did/does the research seek inputs from participants (members of the Indigenous community) regarding a community's cultural heritage, artifacts, traditional knowledge, biocultural or biological resources or unique characteristics/practices?

Yes

1.4 Did/will Aboriginal identity or membership in an Indigenous community used or be used as a variable for the purposes of analysis?

Yes

2. Community Engagement

2.1 If you answered "Yes" to questions 1.1, 1.2, 1.3 or 1.4, have you initiated or do you intend to initiate an engagement process with the Indigenous collective, community or communities for this study?

Yes

2.2 If you answered "Yes" to question 2.1, describe the process that you have followed or will follow with respect to community engagement. Include any documentation of consultations (*i.e., formal research agreement, letter of approval, PIC, email communications, etc.*) and the role or position of those consulted, including their names if appropriate:

To secure an interview with the resource persons of the study who belonged to an indigenous community, I foremostly took permission from the village headmen or Gaonburas as they are the titular head of the village. A series of emails were exchanged, and calls made before I secured an interview and permission to stay in the villages. The village headmen identified the Village elders and women who were adept in their traditional knowledge. Interviews were taken thereon after the suggestions of the village headmen.

I stayed at the dormitory of the village clubhouse during the study. I accompanied the village women in their wild hunt for food and edibles, collection of fuel, for drawing water etc. as per the process of participant observation.

Personal interviews were recorded and transcribed. Thumb impression/signatures were taken of the transcriptions.

Serial No.	Name	Designation	Address
1.	Bida Ronghang	Village headman	Ambinong, Hamren
2.	Sika Phangchopi	Herbalist	Ambinong, Hamren
3.	Kuntala Teronpi	Ethno-gynaecologist	Harlongjuve, Hamren
4.	Kache Timungpi	Village elderly woman	Harlongjuve, Hamren
5.	Rupta Tissopi	Herbalist	Phonglangso, Langlokso
6.	Man Tisso	Village headman	Phonglangso, Langlokso
7.	Jirka Teronpi	Handloom expert	Phonglangso, Langlokso
8.	Mirdan Kropi	Handloom expert	Phonglangso, Langlokso
9.	Klirdap Timungpi	Handicrafts expert	Phonglangso, Langlokso

List of people who were interviewed.

3. No Community Consultation or Engagement

If you answered “No” to question 2.1, briefly describe why community engagement will not be sought and how you can conduct a study that respects Aboriginal/ Indigenous communities and participants in the absence of community engagement.

Name of Principal Researcher: Laxmi Hansepi

Affiliation of Principal Researcher: Ph.D. Research Scholar, Gauhati University

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